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Project Report

PA-229-8
(RSP)

C. R. Berndtson
R. H. French
D. E. Nessman

Data Reduction Program Documentation ALCTAP

(Effective: April 1971)

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5 May 1971

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY
Lexington, Massachusetts

Unclassified

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MASSACHUSETTS INSTITUTE OF TECHNOLOGY

LINCOLN LABORATORY

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DATA REDUCTION PROGRAM DOCUMENTATION ALCTAP

(EFFECTIVE: APRIL 1971)

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L G Hanscom Field

Bedford, Mass 01731

LEXINGTON MASSACHUSETTS

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FOREWORD

This is the eighth report in the Data Reduction Program Documentation series. It is dated according to the date of completion of the documentation. No implicati is made that this program will not subsequently be modified, amended, or superseded; on the contrary, the history of radar data processing is one of continuous evolution of techniques, and it is unrealistic to assume that steady-state has been reached. The PA-229 series is being published for the convenience of interested parties, and Lincoln assumes no responsibility for the correctness of the information presented, nor for its currency.

The preparation of reports in this series is under the Editorship of Charles R. Berndtson of Lincoln, and of D. Nessman and R. French of Philco-Ford Corporation. Inquiries, suggestions, corrections, criticisms, and requests for additional copies should be directed to C. R. Berndtson.

The principal contributor to this report was G. L. Shapiro (Philco-Ford). Due to the intricate, evolutionary manner in which the programs came into being, the editors regret that it is in general impossible to give due credit to all -- mathematicians or radar analysts or programmers -- who contributed to the definition and writing of the programs.

Alan A. Grometstein

Alan A. Grometstein

CONTENTS

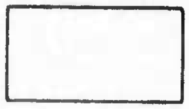
COMMON SYMBOLS AND ABBREVIATIONS

(The units given for certain quantities are the units commonly used for those quantities, unless otherwise noted.)

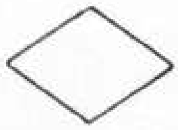
ADT	ALCOR Data Tape
ALCOR	ARPA-Lincoln C-band Observables Radar
ALTAIR	ARPA Long-Range Tracking and Instrumentation Radar
Alt	Altitude (km)
APS	Average Pulse Shape
ARS	ALTAIR Recording System
Avg	Average, Averaging
Az	Azimuth (deg)
c	Speed of Light
CADJ	Adjusted Calibration Constant (db)
C-band	ALCOR frequency, 5664 MHz (NB) and 5667 MHz (WB)
DBLT	Wide Band Pulse Doublet
El	Elevation (deg)
EOF	End of File
GMT	Greenwich Mean Time
h	Hours
Hz	Hertz
IF	Intermediate Frequency
in	Inches
LC	Left Circular Polarization
lsb	Least Significant Bit
min	Minutes
NB	Narrow Band
NRTPOD	Non-real Time Precision Orbit Determination Program
POD	Project PRESS Operation and Data Summary Report
Phase	Presented in deg
PRF	Pulse Repetition Frequency (pps)
PRI	Pulse Repetition Interval (s)
pps	Pulses per second
pts	Points

R	Range (km)
$\dot{R}$	Range Rate (km/s)
rad	Radians
RC	Right Circular Polarization
RCS	Radar Cross Section (dbsm)
RF	Radio Frequency
s	Seconds
SD_w	Standard Deviation of Wake Velocity
SDBLT	Wide Band Slaved Pulse Doublet
S/N	Signal-to-noise Ratio
T	Time
TAL	Time After Launch (s)
UHF	ALTAIR Frequency; 415 MHz
V	Velocity
V_d	Doppler Velocity
V_w	Mean Wake Velocity
VHF	ALTAIR Frequency; 155.5 MHz
WB	Wide Band
WBS	Wide Band Slaved
WTR	Western Test Range
θ	Total Off-axis Angle (deg)
λ	Wavelength
*	Denotes Multiplication

FLOW DIAGRAM SYMBOLS

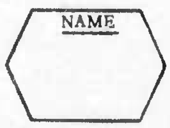


PROCESS, ANNOTATION



DECISION

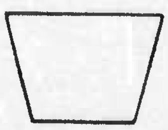
TERMINATOR



SUBROUTINE: where NAME is the entry call into the subroutine

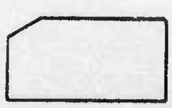
CONNECTOR: where P specifies a page in the flow diagram, and L designates a statement number in the program listing or a reference point in the flow diagram

CONNECTOR: where X implies a continuation of the diagram to the next page

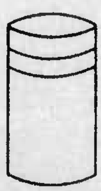


INPUT/OUTPUT OPERATION

MAGNETIC TAPE



PUNCHED CARD



DISK

ALCTAP

1. PURPOSE and UTILIZATION

A. Source of Data

ALCOR[1]

B. Data Input

ALCOR Data Tape (ADT)

C. Description

ALCTAP is designed to obtain ~~RCS~~ radar cross section data on waking targets ~~(NB and WB)~~ (narrowband and wideband) and on multiple radar scattering centers ~~(WB)~~ (wideband). It computes ~~LC and RC RCS~~ for up to 170 range cells. It is usually run every 0.1 s with the data averaged over 0.1 s.

D. Output

1. A listing of RCS data (LC and RC) for up to 60 gates.[#]

2. Plots of RCS vs relative range[##] for each averaging interval (optional). This is a non-coherent Average Pulse Shape (APS) which gives the relative position and intensity of radar scattering centers (WB) and non-coherent body and wake RCS (NB and WB).[#]

3. Punched cards containing Alt and peak RCS over a pre-selected set of range gates (optional). These cards are edited and then used in a plotting program to produce the peak wake plot.

4. Plots of LC and RC peak wake RCS vs Alt to aid in editing cards for final plots.

left and right circular polarization radar cross sections

[#] Separate listings and plots are produced for each range offset for WB tapes if requested.

[##] The range span is determined by selecting initial and final gates.

II. DESCRIPTION

ALCTAP computes average RCS as a function of range gate and time. ALCTAP will process both RC and LC channels in one run for the printout, punched cards, and peak wake plots, but will only produce APS plots for one selected polarization/run. The program averages in m^2 and then converts to dbsm for printouts and plots.

The averaging interval and skip time are selected by the number of pulses to be averaged (INTAV) and the number of pulses to be skipped (ISKIP). Since averaging interval (s) = INTAV/PRF, and skip interval (s) = ISKIP/PRF, the averaging interval and skip interval will change whenever the PRF changes.

Only primary pulses (pulses with zero range offset) are included in INTAV, ISKIP, and PRF.

For wide band slaved (WBS), doublet (DBLT), and slaved doublet (SDBLT) waveforms, the program will average or skip all inclusive slaved or slaved doublet pulses with the same range offsets. This means that all non-primary pulses[#] should be ignored when averaging and skip intervals are being determined, since the program will handle these pulses automatically.

RCS is computed as follows:

$$\text{LC RCS} = \text{XATBL(N)} + 40 \log R + \text{XPPAGC} + \text{CONLC} - \text{POWERT}$$

$$\text{RC RCS} = \text{XATBL(M)} + 40 \log R + \text{XOPAGC} + \text{CONRC} - \text{POWERT}$$

where

XATBL(N) is obtained by indexing the LC calibration table with the LC amplitude values obtained in the ADT data record.[1]

XATBL(M) is obtained by indexing the RC calibration table with the RC amplitude values obtained in the ADT data record.[1]

[#] Pulses offset in range.

XPPAGC is total LC attenuation $(db)^2$

XOPAGC is total RC attenuation $(db)^2$

CONLC# and CONRC# are calibration constants (db) obtained from Calibration Record Words 624 (NB LC), 625 (NB RC), 627 (WB LC), and 628 (WB RC)

POWERT (peak transmit power in dbw) for NB
= PWRCN + PWRSN log XPKPWR

POWERT for WB
= PWRSN + PWRSW log XPKPWR

where

PWRCN is Calibration Record Word 620

PWRSN is Calibration Record Word 621

PWRCW is Calibration Record Word 622

PWRSW is Calibration Record Word 623

XPKPWR is ADT Record Byte 344

R, Az, and El are corrected as follows:

R = IRANGE + TRBIAS + TTCOR + RRCOR - RCORF

Az = IAZ + AZBIAS

El = IEL + ELBIAS - ECORF

where

IRANGE is uncorrected R

TRBIAS is range bias

TTCOR (transit time correction) = $R\dot{R}/c$

RRCOR is range doppler coupling correction

RCORF is tropospheric refraction correction

IAZ is Az encoder angle

AZBIAS is Az bias (Calibration Record Word 602)

#Called KRCS (LC) and KRCS (RC) on output listing.

IEL is El encoder angle

ELBIAS is El bias*(Calibration Record Word 603)

ECORF is tropospheric refraction correction

Alt is computed as follows:

$$Alt = (R^2 + R_e^2 + 2\,RR_e \sin El)^{\frac{1}{2}} - R_e$$

where R_e = radius of earth (6378.145 km)

Before processing, the main program checks that ITBAND (tape) = IBAND (input). This determines that if WB data is requested, WB data exists on the tape requested.

III. OPERATION

A. Input

Launch time (total GMT ms)

Waveform and polarization (APS only)

Averaging interval (pulses)

Skip interval (pulses)

Start and stop range gates for listing, APS plots, and peak wake RCS search

First and last pulse nos. of processing intervals

No. of processing intervals

Scale factors for APS plots

Glitch remover (only used when site has serious problem with A/D counter)

Options for plotting, punching, and deleting non-primary pulses from output

A sample input is shown in Appendix A.

CARD 1 (I10, 12I5, 1X, A4)

(Col.)		
1-10	ILNCH	Launch time in total GMT ms
11-15	NCELL1#	Initial gate for APS plot (1)
16-20	NCELL2#	Final gate for APS plot (170)
21-25	NBAND	0 = NB; 1 = WB
26-30	IPOLAR	0 = LC APS only; 1 = RC APS only
31-35	IPLOT	0 = APS plots; 1 = no APS plots
36-40	ICELP1#	Initial gate for listing (46)##
41-45	ICELP2#	Final gate for listing (105)

#If left blank, program sets to indicated value.

##Program will not list more than 60 gates.

(Col.)		
46-50	INTAV	No. of pulses in averaging interval
51-55	ISKIP	No. of pulses between averaging intervals
56-60	IPEAK1#	Initial gate for search for peak wake RCS (54)##
61-65	IPEAK2#	Final gate for search for peak wake RCS (90)
66-70	NVALS	No. of processing intervals
72-75	TITL	Title for listing and plots

CARD 2 (2F10.3, 3I10)

1-10	DBB#	Minimum value for ordinate of plots (-60 dbsm)
11-20	DBT#	Maximum value for ordinate of plots (+40 dbsm)
21-30	IPKAD#	A/D count limit (130)
31-40	IPUNC	0 = punched peak wake cards 1 = no punched cards
41-50	IPRIME	0 = All pulses are output 1 = Primary pulses only are output

CARD 3 (6I10)

1-10	NSTART	First pulse no. of initial processing interval
11-20	NSTOP	Last pulse no. of initial processing interval
21-30	NSTART	First pulse no. of second processing interval
31-40	NSTOP	Last pulse no. of second processing interval
41-50	NSTART	First pulse no. of third processing interval
51-60	NSTOP	Last pulse no. of third processing interval

Repeat Card 3 as necessary.

If left blank, program sets to indicated value.

Only primary pulses used to determine peak wake RCS.

B. Output

LISTING

Selected input parameters

First and last pulse nos.[#] in averaging interval (includes primary and offset pulses)

KRCS (LC) and KRCS (RC)[##]

No. of pulses averaged

TAL, GMT total s, and GMT h, min, s, and ms

R, $\mathring{R}$, range offset, Alt, AGC (dbsm)[†]

Average RCS[††] (LC and RC) for each range gate selected in ICELP1 and ICELP2

APS PLOTS

RCS vs relative range (m)

PEAK WAKE PLOTS

Peak Wake RCS vs Alt

PUNCHED PEAK WAKE DATA

CARD 1: Polarization (A2), bandwidth (2X, A2), Title (2X, A4)

CARD 2: Alt (F10.3), RCS (F10.3)

A set of Alt and RCS cards are produced for each polarization.

Sample outputs are given in Appendix B.

[#] Called PRI (start) and PRI (stop) in listing.

[##] Also called CONLC and CONRC.

[†] AGC is the total LC or RC attenuation, depending on the polarization selected for APS plots.

[††] For each range offset.

IV. PROGRAM LIMITATIONS

NVALS	≤ 50 processing intervals
[ICELP2 - ICELP1]	≤ 60 gates
Length of run	≤ 2000 averaging intervals

No. of range offsets on tapes during averaging interval must not exceed 20 (including 0 offset). If greater than 20, only first 20 will be processed.

V. PROGRAMMING

A. TAPALC (see Appendices C and D.)

TAPALC is the control section of ALCTAP. TAPALC reads the input cards, makes the call to READJS, and averages the data returned. TAPALC separates the pulses according to range offset, searches for the peak response, and saves this value along with its corresponding altitude. TAPALC also calls the subroutines that plot and print the data.

B. HEDADT (see Appendix E.)

Subroutine HEDADT unpacks the ADT header record which contains bandwidth, reel no., WTR no., date of mission, and mission designator. The call statement is HEDADT [ISIG,[#] INBUF(1), IEQM(1)] .

INPUT

INBUF(1)	First word in the ADT header record[##]

OUTPUT

IEQM(1)	IZBAND	(bandwidth: 1 = WB, 0 = NB)
IEQM(2)	ITREEL	(reel no.)
IEQM(3)	ITWTR	(WTR no.)
IEQM(4)	IMTH	(Date of test)
IEQM(5)	IDAY	
IEQM(6)	IYR	
IEQM(7-9)	ITDESG	(mission designator)

C. READJS[2]

The first call to subroutine READJS opens the file and reads the ADT header record. The second call to READJS reads the ADT calibration record and

[#] Not used.

[##] INBUF (2) to INBUF (1803) contain the remaining words in the record.

stores the values in a buffer area. TAPALC extracts the individual calibration values it requires. Each subsequent call to READJS reads an ADT data record consisting of eight ALCOR pulses.

D. UNPACK[2]

Subroutine UNPACK unpacks the raw data from the ADT, and translates it into a format usable by the IBM 360/67 computer.

E. REFC (see Appendix F.)

The tropospheric refraction correction subroutine, REFC, is based on tropospheric refraction tables in PPP-36.[3] A modified version of this subroutine is now in use.

The call statement is REFC (E, R, DEE, DRR)

E	Uncorrected El (must be between 0° and 90°)
R	Uncorrected R (ft)
DEE	El tropospheric correction
DRR	R tropospheric correction (ft)

The corrected values to be computed after exiting from the REFC routine are:

El = E - DEE
R (ft) = R - DRR

F. PLOTT

Subroutine PLOTT plots the APS and peak wake RCS plots.

REFERENCES

1. "ALCOR Data Users Manual", LM-86, Lincoln Laboratory, M.I.T. (17 June 1970), UNCLASSIFIED.

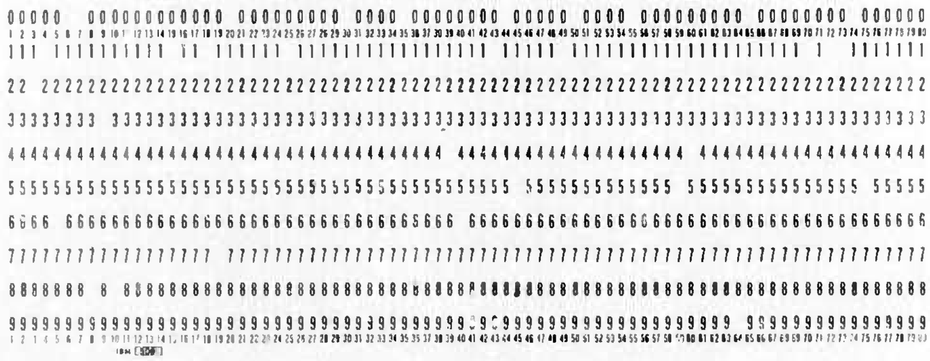
2. "Data Reduction Program Documentation, ALCOR Tape Read Package, (Effective: April 1971)", PA-229-7, Lincoln Laboratory, M.I.T. (26 April 1971), UNCLASSIFIED.

3. J.P. Penhune, "Refraction Corrections for the TRADEX Radar", PPP-36, Lincoln Laboratory, M.I.T. (21 April 1965), UNCLASSIFIED.

APPENDIX A
ALCTAP INPUT

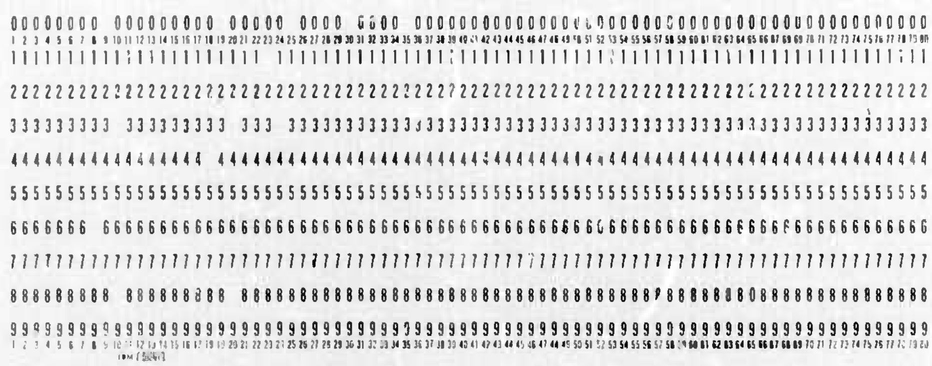
21600838 1 170 1 0 0 46 105 10 0 54 90 1 1J05

CARD 1



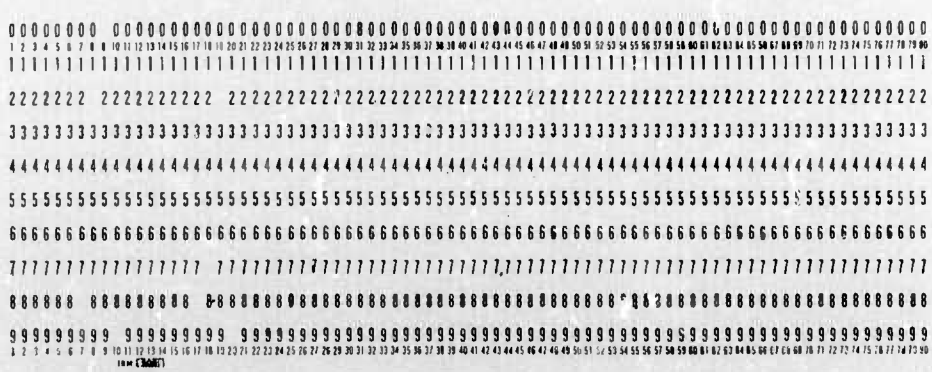
-60. 40. 130 0 0

CARD 2



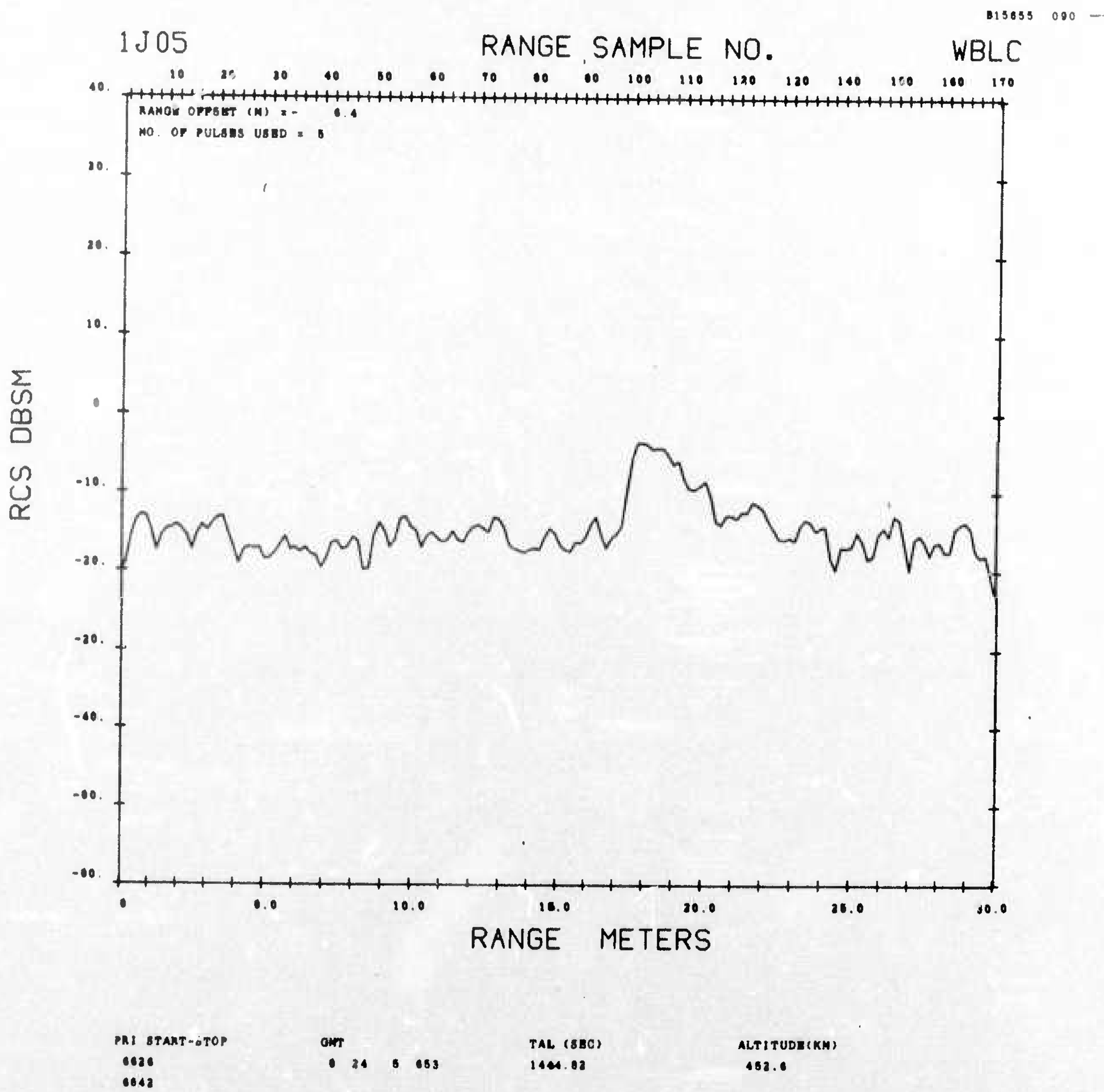
8209 8729

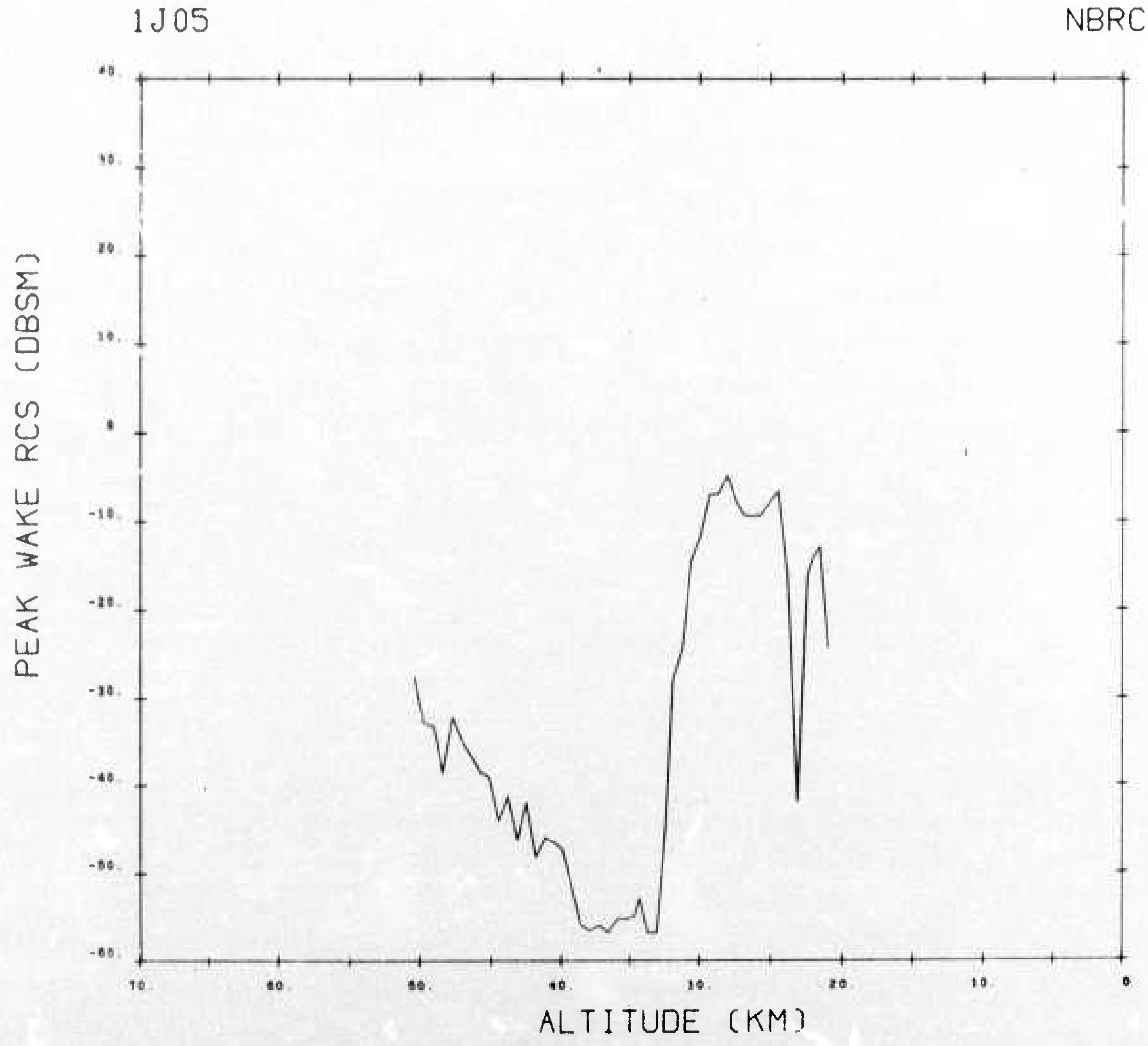
CARD 3



APPENDIX B
ALCTAP OUTPUTS

```
TAP-ALCOR   POLAR = LC    BAND = WB    REEL NO. =     1   TITLE = 1J05   DATE =  2/28/71

CELL BEGIN (PLOT) =   1     CELL BEGIN (PRINT) =  46     CELL BEGIN (PEAK ) =  54     KRCS(LC) =  -88.500    IBAND = 1   IPLOT = 0

CELL END   (PLOT) = 170     CELL END   (PRINT) = 105     CELL END   (PEAK ) =  90     KRCS(RC) =  -85.600    IPOLAR= 0

        INTAV =  10              ISKIP =   0

START   STOP                 START   STOP                START   STOP                START   STOP
 8209   8729

   LIFT OFF TIME =  21600.838

    *TIME(GMT)  6 24  0. 63         TAL  1439.225 RANGE(KM) 1158.830      R.OFFST(M) =        0.0        HEIGHT (KM)  464.5
  TSEC 23040.063    AGC(OBSM) =   0.0   PRI(START)   8209   PRI(STOP)   8222   NO.PULSES =  10.  ROOT (M/SEC) = -6275.016
                    RANGE GATES     46    47    48    49    50    51    52    53    54    55    56    57    58    59    60
                             LC  -14.1 -14.2 -14.5 -11.8  -7.5  -3.7  -2.2  -1.7  -1.0  -0.2  -0.0  -1.4  -4.1  -7.3 -10.5
                             RC  -10.9  -9.4  -8.6  -8.6  -8.4  -9.7 -10.5  -9.7  -7.5  -3.9  -0.2   1.4   1.5   1.2  -1.1
                    RANGE GATES     61    62    63    64    65    66    67    68    69    70    71    72    73    74    75
                             LC  -10.6 -12.1 -15.5 -17.3 -15.4 -17.5 -17.0 -16.3 -15.9 -14.3 -14.1 -14.5 -14.5 -14.0 -15.3
                             RC   -3.6  -7.2 -10.9 -11.5 -10.3  -9.8  -9.3 -10.9 -10.9 -11.2 -11.0 -11.0 -11.7 -11.9 -11.1
                    RANGE GATES     76    77    78    79    80    81    82    83    84    85    86    87    88    89    90
                             LC  -16.0 -15.8 -15.8 -14.3 -13.0 -12.8 -14.1 -14.9 -15.1 -14.5 -13.9 -14.2 -14.7 -15.2 -15.1
                             RC  -11.4 -12.0  -9.5  -8.7 -10.2 -12.1 -11.6 -11.0  -9.0  -8.5  -8.0  -9.6 -11.3 -11.2 -11.9
                    RANGE GATES     91    92    93    94    95    96    97    98    99   100   101   102   103   104   105
                             LC  -15.9 -16.7 -17.3 -17.0 -16.6 -16.4 -16.3 -15.0 -14.1 -14.5 -14.7 -14.4 -15.9 -15.7 -15.8
                             RC  -13.4 -11.2  -9.7  -9.1  -8.7  -9.7 -11.1 -10.7 -10.3  -9.5  -9.7  -9.9 -10.8 -11.0 -10.8

     TIME(GMT)  6 24  0. 63         TAL  1439.225 RANGE(KM) 1158.830      R.OFFST(M) =       30.0        HEIGHT (KM)  464.5
  TSEC 23040.063    AGC(OBSM) =   0.0   PRI(START)   8209   PRI(STOP)   8222   NO.PULSES =   4.  ROOT (M/SEC) = -6275.016
                    RANGE GATES     46    47    48    49    50    51    52    53    54    55    56    57    58    59    60
                             LC  -15.5 -14.0 -12.8 -15.7 -20.1 -16.7 -18.2 -18.3 -17.4 -18.2 -19.2 -16.7 -15.8 -15.7 -15.0
                             RC   -6.1  -6.5  -7.9  -9.0  -8.8  -8.5  -9.4 -10.2 -11.6  -9.7  -7.0  -5.7  -7.8 -13.1 -13.5
                    RANGE GATES     61    62    63    64    65    66    57    58    69    70    71    72    73    74    75
                             LC  -16.4 -17.9 -18.4 -15.4 -13.0 -12.6 -13.6 -18.6 -17.7 -15.0 -14.3 -11.8 -12.1 -12.0 -12.2
                             RC  -11.3 -10.5 -11.8 -10.1 -10.0 -10.8 -12.6 -13.1 -11.4 -10.3 -10.5 -10.9 -10.6 -13.1 -12.2
                    RANGE GATES     76    77    78    79    80    81    82    83    84    85    86    87    88    89    90
                             LC  -14.8 -17.7 -17.0 -15.4 -14.4 -15.6 -17.6 -15.1 -15.5 -15.8 -15.4 -14.3 -15.7 -16.3 -13.7
                             RC  -11.6 -10.5  -9.5 -10.1 -11.4 -10.9 -10.6 -12.9 -12.8 -12.0 -11.3  -8.8  -7.8  -9.2 -11.7
                    RANGE GATES     91    92    93    94    95    96    97    98    99   100   101   102   103   104   105
                             LC  -12.1 -12.5 -14.8 -15.6 -17.5 -17.2 -15.4 -14.8 -14.9 -15.2 -13.8 -14.3 -13.0 -13.3 -12.3
                             RC  -11.5  -9.0  -7.2  -8.1  -7.5  -8.8 -10.8 -11.6 -11.2  -9.6  -9.8  -9.8 -10.8  -9.0  -8.4
```


B15655 090
1J05
RANGE SAMPLE NO.
WBLC
RANGE OFFSET (M) = - 6.4
NO. OF PULSES USED = 5
RCS DBSM
RANGE METERS
PRI START-STOP
6626
6642
GMT
6 24 5 653
TAL (SEC)
1464.82
ALTITUDE(KM)
452.6


1J05
NBRC
40.
30.
20.
10.
0
-10.
-20.
-30.
-40.
-50.
-60.
PEAK WAKE RCS (DBSM)
70.
60.
50.
40.
30.
20.
10.
0
ALTITUDE (KM)

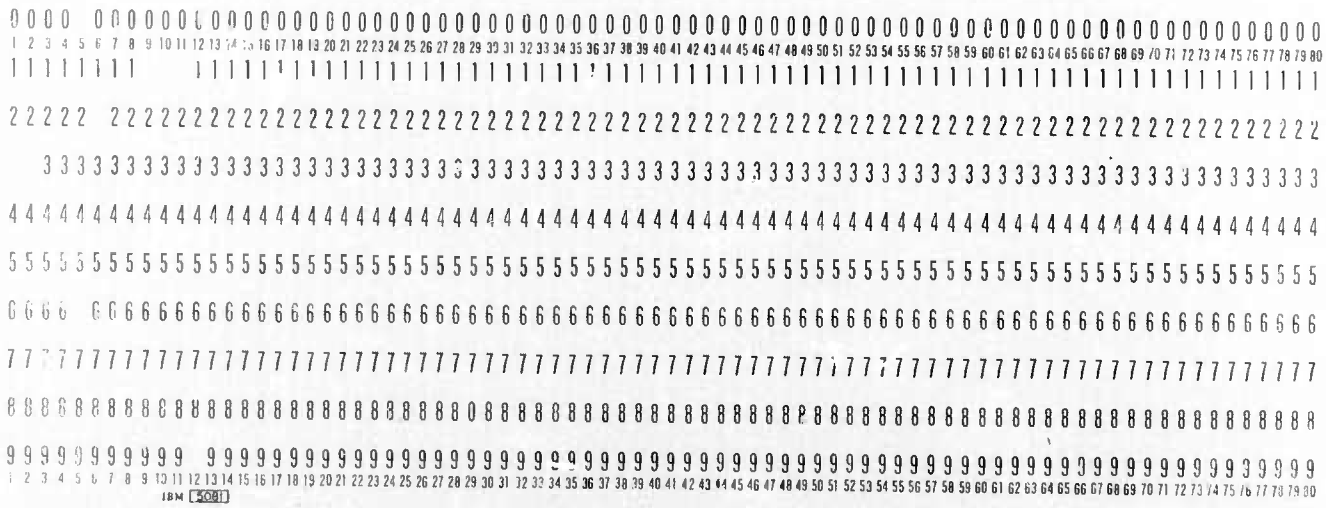
Polarization

Bandwidth

Title

LC WB 1J19

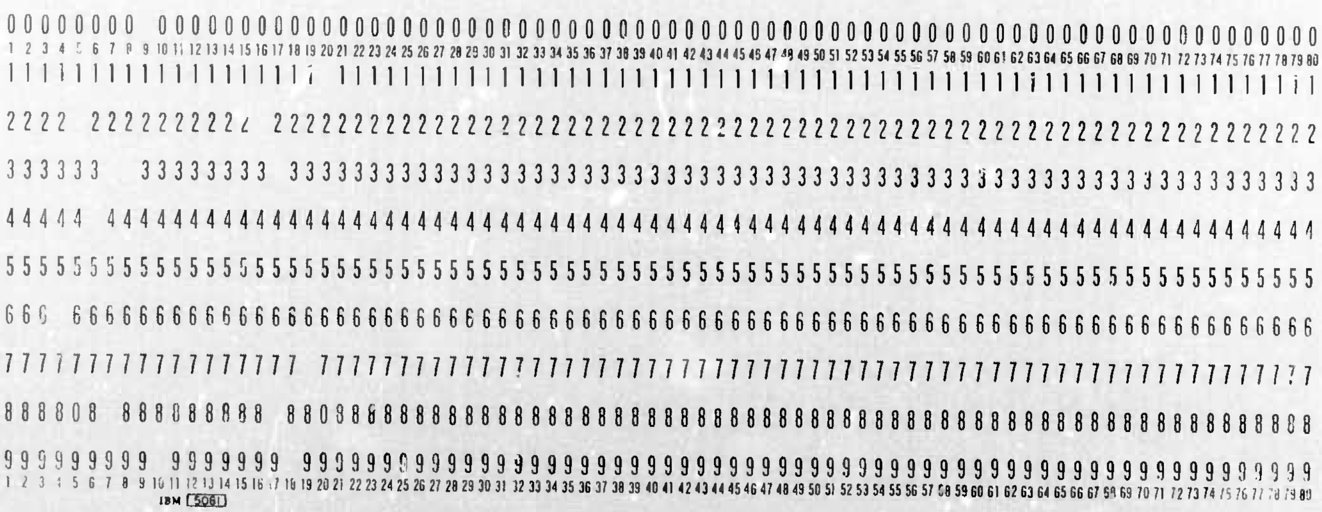
CARD 1



Alt RCS

624.309 -2.971

CARD 2



APPENDIX C
TAPALC PROGRAM LISTING

```
      DOUBLE PRECISION XLNCH,D1000,TAL,TCTL,TALBEG,TOTBEG
C
      DIMENSION NSTART(50),NSTOP(50)
      DIMENSION XLCSUM(20,170),XRCSUM(20,170),IAVLC(20,170),IAVRC(20,170
     1),XATBL(128),XLCDB(170),XRCDB(170),ILCAMP(170),IRCAMP(170)
     2,ILCPHA(170) ,IRCPHA(170),              YPRNT(170)
      DIMENSION IOUT(170),QBIAS(8)
      DIMENSION XNBUF(1803),PIFA(16),OIFA(16),            XKRCS(5)
      DIMENSION IECM(9),ITDESG(3),XSRANG(20)
      DIMENSION IJCONT(20)
C
      COMMON/ICOM/INBUF(1803),IAZ,IEL,INDEX,IPPRCS,IORS,IRANGE,IPKPWR,IR
     1DOT,IALT,INDAZ,JNDAZ,INDEL,IRB54,IRB85,IOPRCS,I240B1,I240B2,I240B3
     1,I241B1,I241B2,I241B3,XPPAGC,IBETA,NEWA,IBAND,NSW,RBIAS(8),ISVPRI,
     1IHRS,IMIN,ISEC,IMSEC,ISTAT(21),TRBIAS,ISTAT1,ISTAT2,ISTAT3,ISTAT4,
     1IALSW,ISTSW,NBWB,ISIGNC,I27B12,JCON,NBEG,NEND,ITST,NUMPRI,XOPAGC,
     1ITBAND,ITAPNC,IPRF,IPOLAR,ISSERR,PIFA,OIFA,PFSA,OFSA,PSSA,OSSA,
     1PSSL,OSSL,ICCDF,I273B5,I273B6,I273B7,I273B8,IMCVP,IMCVC,IOFFST,
     1IDAT(682)
      COMMON /ICLZ/ JJ,TITL,ALTI(2000),YLC(2000),YRC(2000)
C
      EQUIVALENCE (ILCAMP(1),IDAT(1)),(ILCPHA(1),IDAT(171)),(IRCAMP(1),
     1IDAT(341)),(IRCPHA(1),IDAT(511))
      EQUIVALENCE(XNBUF(1),INBUF(1))
      EQUIVALENCE (IECM(1),IZBAND),(IECM(2),ITREEL),(IECM(3),ITWTR),
     2(IECM(4) ,IMTH  ),(IECM(5),IDAY ),(IECM(6),IYR),
     3(IECM(7),ITDESG(1))
C
      DATA ZLC/'LC  '/,ZRC/'RC  '/,ZWB/'WB  '/,ZNB/'NB  '/
      DATA IFRST1/0/,IFRST2/0/,IFRST3/0/,IFRST4/0/
      DATA ER /6378.145/,D1000/1000.D0/
      DATA IBLANK/'    '/,IASTR/'*   '/
C
C        IPOLAR = 0 LEFT CIRCULAR DATA REQUESTED
C        IPOLAR = 1 RIGHT CIRCULAR DATA REQUESTED
C        NBAND = 0  NARROW BAND DATA REQUESTED
C        NBAND = 1  WIDE BAND DATA REQUESTED
C        IPLOT = 0  SC4060 PLOTS
C        IPLOT = 1  NO SC4060 PLOTS
C        IPUNC = 0 PUNCH ALT. VS RCS CARDS
C        IPUNC = 1 NO PUNCHED CARDS
C        NEWA = 0    MISSION FLOWN BEFORE 15 OCT 70 (OLD ATTN.)
C        NEWA = 1    MISSION FLOWN AFTER  15 OCT 70 (NEW ATTN.)
C
      READ(5,1)ILNCH,NCELL1,NCELL2,NBAND,IPOLAR,IPLOT,ICELP1,ICELP2,
     1INTAV,ISKIP,IPEAK1,IPEAK2,NVALS,TITL,DBB,DBT,IPKAD,IPUNC,IPRIME,
     2(NSTART(I),NSTOP(I),I=1,NVALS)
    1 FORMAT(I10,12I5,1X,A4/2F10.3,3I10/(6I10))
      NNSET=ISKIP
```

```
C
      IEOF=0
      IERR=0
      CALL READJS(INBUF,IEOF,IERR)
      ISIG=1
      CALL HEDADT (ISIG,INBUF(1),IEQM(1))
      ITBAND=IZBAND
      NEWA=0
      IF(IYR.GT.70)GO TO 282
      IF(IYR.LT.70)GO TO 283
      IF(IMTH.GT.10)GO TO 282
      IF(IMTH.LT.10)GO TO 283
      IF(IDAY.LT.15)GO TO 283
  282 NEWA=1
  283 CONTINUE
      IERR=0
      CALL READJS(INBUF,IEOF,IERR)
C
C          STORE THE DESIRED CALIBRATION VALUES
C
      N=0
      DO 20 K=256,383
      N=N+1
   20 XATBL(N)=XNBUF(K)
C
      N=0
      DO 22 K=512,527
      N=N+1
   22 PIFA(N)=XNBUF(K)
      N=0
      DO 23 K=528,543
      N=N+1
   23 OIFA(N)=XNBUF(K)
C
      PFSA=XNBUF(592)
      PSSA=XNBUF(593)
      OFSA=XNBUF(594)
      OSSA=XNBUF(595)
C
      ABIAS=XNBUF(602)
      EBIAS=XNBUF(603)
      DEGCON=(180.*.0479369)/3141.59
      AZBIAS=DEGCON*ABIAS
      ELBIAS=DEGCON*EBIAS
C
      N=0
      DO 25 K=604,611
      N=N+1
      QBIAS(N)=XNBUF(K)
   25 RBIAS(N)=QBIAS(N)
C
      PWRCN=XNBUF(620)
      PWRSN=XNBUF(621)
      PWRCW=XNBUF(622)
      PWRSW=XNBUF(623)
C
      N=0
```

```
      DO 27 K=624,628
      N=N+1
   27 XKRCS(N)=XNBUF(K)
C
      PSSL=XNBUF(629)
      OSSL=XNBUF(630)
C
      JCON=-1
      INDEX=0
      ITST=1
      JJ=0
      IPULS=0
      JX=20
      NPRMRY=0
C
      DO 120 IJ=1,NVALS
      NBEG=NSTART(IJ)
C
      NM=1
      DO 72 M=1,JX
      IJCONT(M)=0
      XSRANG(M)=0.
      DO 72 K=1,170
      IAVLC(M,K)=0
      IAVRC(M,K)=0
      XLCSUM(M,K)=0.
      XRCSUM(M,K)=0.
   72 CONTINUE
C
    3 JCON=JCON+1
      IF(JCON.EQ.9.OR.JCON.EQ.0)GO TO 97
      INDEX=(JCON-1)*900
      GO TO 99
   97 JCON=1
      INDEX=0
   98 IEOF=0
      IERR=0
      CALL READJS(INBUF,IEOF,IERR)
      IF(IERR.EQ.1)GO TO 103
   99 CALL UNPACK
      XOFFST=(FLOAT(IOFFST)/2048.)*14.989625
      IF(ICODE.EQ.5)XOPAGC=XPPAGC
      IF(ICODE.EQ.7)XOPAGC=XPPAGC
      IF(IFRST2.EQ.1)GO TO 92
      IF(NCELL1.LE.0)NCELL1=1
      IF(NCELL2.LE.0)NCELL2=170
      IF(IPKAD.LE.0)IPKAD=130
      IF (ICELP2.GT.0.AND.ICELP1.GT.0)GO TO 93
      ICELP1=46
      ICELP2=105
      GO TO 95
   93 IF((ICELP2-ICELP1+1).LE.60)GO TO 95
      ICELP2=ICELP1+59
   95 CONTINUE
      IF(IPEAK1.GT.0.AND.IPEAK2.GT.0)GO TO 96
      IPEAK1=54
      IPEAK2=90
```

```
   96 CONTINUE
      ZBAN=ZNB
      IF(ITBAND.EQ.1)ZBAN=ZWB
      ZPOL=ZLC
      IF(IPOLAR.EQ.1)ZPOL=ZRC
      RRUSE=-.00943
      IF(ITBAND.EQ.1)RRUSE=-.000115
      PWRUS1=PWRCN
      IF(NBAND.EQ.1)PWRUS1=PWRCW
      PWRUS2=PWRSN
      IF(NBAND.EQ.1)PWRUS2=PWRSW
      CONLC=XKRCS(1)
      CONRC=XKRCS(2)
      IF(NBAND.NE.1)GO TO 17
      CONLC=XKRCS(4)
      CONRC=XKRCS(5)
   17 CONTINUE
      IF(ICODE.EQ.5)CONRC=CONLC
      IF(ICODE.EQ.7)CONRC=CONLC
C
      WRITE(6,200)ZPOL,ZBAN,ITREEL,TITL,(IEGM(I),I=4,6)
  200 FORMAT('1TAP-ALCOR    POLAR = ',A2,4X,'BAND = ',A2,4X,'REEL NO. = '
     1,I5,'    TITLE = ',A4,'    DATE = ',I2,'/',I2,'/',I2)
      WRITE(6,208)NCELL1,ICELP1,IPEAK1,CONLC ,NBAND,IPLOT
  208 FORMAT('OCELL BEGIN (PLOT) = ',I3,5X,'CELL BEGIN (PRINT) = ',I3,5X
     1,'CELL BEGIN (PEAK ) = ',I3,5X,'KRCS(LC) = ', F8.3
     1                   ,4X,'IBAND = ',I1,3X,'IPLOT = ',I1)
      WRITE(6,210) NCELL2,ICELP2,IPEAK2,CONRC, IPOLAR
  210 FORMAT('OCELL END    (PLOT) = ',I3,5X,'CELL END    (PRINT) = ',I3,5X
     1,'CELL END    (PEAK ) = ',I3,5X,'KRCS(RC) = ', F8.3
     1                   ,4X,'IPOLAR= ',I1)
      WRITE(6,211)INTAV,NNSET
  211 FORMAT('0',12X,'INTAV = ',I3,18X,'ISKIP = ',I3)
      WRITE(6,212)(NSTART(I),NSTOP(I),I=1,NVALS)
  212 FORMAT('0 START    STOP      ',12X,'START    STOP      ',12X,'START
     1STOP      ',12X,'START    STOP      ' /(4(2X,I5,2X,I5,15X)))
      XLNCH=DFLOAT(ILNCH)/D1000
      WRITE(6,214)XLNCH
  214 FORMAT('0      LIFT OFF TIME = ',F10.3)
C
      IF(NBAND.NE.ITBAND)GO TO 695
      IFRST2=1
   92 CONTINUE
C
  620 IF(NUMPRI.LT.NSTART(IJ))GO TO 3
      IF(NUMPRI.GT.NSTART(IJ))GO TO 628
C
      ITST=1
      NSWIT=1
      IF(ICODE.EQ.3.OR.ICODE.EQ.7.OR.ICODE.EQ.2)GO TO 600
      GO TO 629
  600 NSTART(IJ)=NSTART(IJ)+1
      WRITE(6,6314)IJ,NSTART(IJ)
 6314 FORMAT('ONSTART(',I3,') HAS BEEN CHANGED TO ',I10)
      GO TO 3
  628 IF(ICODE.EQ.3.OR.ICODE.EQ.7.OR.ICODE.EQ.2)GO TO 626
  629 IPULS=IPULS+1
```

```
626 IF(INTAV.EQ.1.AND.ISKIP.EQ.0)IPULS=1
631 GO TO (660,661),NSWIT
C
660 ITST=1
    IF(IPULS.NE.INTAV)GO TO 10
    NSWIT=2
    ITST=2
    IPULS=0
    IF(NNSET.EQ.0)NSWIT=1
    GO TO 10
C
661 IF(IPULS.NE.NNSET)GO TO 118
    IPULS=0
    NSWIT=1
    ITST=1
    GO TO 118
C
 10 CONTINUE
    IF(IFRST4.EQ.1)GO TO 341
    IPROLD=IPRF
    XOPOLD=XOPAGC
    XPPOLD=XPPAGC
    IFRST4=1
C
C        DETERMINE OFFSET POSITION OF DATA
C
341 CONTINUE
    IF(ABS(XOFFST-XSRANG(1)).GT.1.)GO TO 343
    MM=1
    NPRMRY=1
    GO TO 342
343 DO 345 K=2,JX
    IF(ABS(XOFFST-XSRANG(K)).GT.1.)GO TO 345
    MM=K
    GO TO 342
345 CONTINUE
    NM=NM+1
    IF(NM.GT.JX)GO TO 19
    MM=NM
    XSRANG(MM)=XOFFST
342 CONTINUE
    IJCONT(MM)=IJCONT(MM)+1
C
    IF(IPOLAR.EQ.1)GO TO 609
    IF(ABS(XPPOLD-XPPAGC).LE.1.)GO TO 610
    WRITE(6,622)NUMPRI,XPPOLD,XPPAGC
622 FORMAT(/2 X'CURRENT PRI = ',I8,'  OLD AGC = ',F5.1,'  CURRENT AGC
   1= ',F5.1)
    XPPOLD=XPPAGC
    GO TO 610
609 IF(ABS(XOPOLD-XOPAGC).LE.1.)GO TO 610
    WRITE(6,622)NUMPRI,XOPOLD,XOPAGC
    XOPOLD=XOPAGC
C
610 IF(IPRF.EQ.IPROLD)GO TO 611
    WRITE(6,624)NUMPRI,IPROLD,IPRF
624 FORMAT(/25X'CURRENT PRI = ',I8 ,'  OLD PRF = ',I5,'  CURRENT PRF =
```

```
 1 ',I5)
   IPROLD=IPRF
   IFRST4=0
611 CONTINUE
   ITOT=(3600*IHRS+60*IMIN+ISEC)*1000+IMSEC
   ITAL=ITOT-ILNCH
   TOTL=DFLOAT(ITOT)/D1000
   TAL=DFLOAT(ITAL)/D1000
   RDOT=(IRDOT/(8192.0))*14.989625
   RANGE=(FLOAT(IRANGE)/2048000.)*14.989625+TRBIAS*.14989625
   TTCOR=    (RANGF/299776.)*(RDOT/1000.)
   RANGE=RANGE+TTCOR
   RRCOR=RRUSE*RDOT
   RANGE=RANGE+RRCOR/1000.
   AZ=(IAZ*2*3141.59265358)/(2.0**17)
   XAZ=AZ*.0572958
   XAZ=XAZ+AZBIAS
   EL=(IEL*2*3141.59265358)/(2.0**17)
   XEL=EL*.0572958
   XEL=XEL+ELBIAS
   CALL REFC(XEL,RANGE,ECORF,RCORF)
   RNGF=RANGE-RCORF
   ELVF=XEL-ECORF
   RADEL=ELVF*.017453
   CALT=SQRT(RNGF**2+ER*ER+2.*RNGF*ER*SIN(RADEL))-ER
   RANGE=RNGF
   XTRR=40.*ALOG10(RANGE)
   XPKPWR=IPKPWR
   POWERT=PWRUS1+PWRUS2*ALOG10(XPKPWR)
C
   IF(IFRST1.EQ.1)GO TO 11
   NPRBEG=NUMPRI
   ALTBEG=CALT
   TALBEG=TAL
   TOTBEG=TOTL
   RDOBEG=RDOT
   RANBEG=RANGE
   POWBEG=POWERT
   XHRB=IHRS
   XMNB=IMIN
   XSCB=ISEC
   XXSB=IMSEC
   IHRB=IHRS
   IMNB=IMIN
   ISCB=ISEC
   IXSB=IMSEC
   XPPBEG=XPPAGC
   XOPBEG=XOPAGC
   IFRST1=1
11 CONTINUE
   NPREND=NUMPRI
C
   DO 39 K=1,170
   IF(K.LT.NCELL1.OR.K.GT.NCELL2)GO TO 39
   N=ILCAMP(K)+1
   IF(N.GT.IPKAD)GO TO 34
   XLCOR(K)=XATBL(N)+XTRR+XPPAGC+CONLC-POWERT
```

```
      XLCSUM(MM,K)=XLCSUM(MM,K)+10.**(XLCDB(K)/10.)
      IAVLC(MM,K)=IAVLC(MM,K)+1
   34 M=IRCAMP(K)+1
      IF(M.GE.IPKAD)GO TO 39
      XRCDB(K)=XATBL(M)+XTRR+XOPAGC+CONRC-POWERT
      XRCSUM(MM,K)=XRCSUM(MM,K)+10.**(XRCDB(K)/10.)
      IAVRC(MM,K)=IAVRC(MM,K)+1
   39 CONTINUE
C
   40 GO TO (199,19),ITST
  199 IF(NUMPRI.NE.NSTOP(IJ))GO TO 118
C
   19 IF(NM.GT.JX)NM=JX
      IF(IPRIME.LE.0)GO TO 41
      NQ=1
      NM=1
   41 CONTINUE
      NQ=1
      IF(NPRMRY.EQ.0)NQ=2
      IF(NQ.EQ.2.AND.IPRIME.GE.1)GO TO 79
      DO 60 LL=NQ,NM
      DO 42 K=1,170
      IF(K.LT.NCELL1.OR.K.GT.NCELL2)GO TO 42
      IF(IAVLC(LL,K).LE.0)IAVLC(LL,K)=1
      IF(XLCSUM(LL,K).LE..00000001)XLCSUM(LL,K)=.00000001
      XLCDB(K)=10.*ALOG10(XLCSUM(LL,K) /FLOAT(IAVLC(LL,K)))
      IF(IAVRC(LL,K).LE.0)IAVRC(LL,K)=1
      IF(XRCSUM(LL,K).LE..00000001)XRCSUM(LL,K)=.00000001
      XRCDB(K)=10.*ALOG10(XRCSUM(LL,K) /FLOAT(IAVRC(LL,K)))
   42 CONTINUE
C
      IF(LL.NE.1)GO TO 55
      XLCPK=-1000.
      XRCPK=-1000.
      DO 44 K=IPEAK1,IPEAK2
      IF(XLCDB(K).GT.XLCPK)XLCPK=XLCDB(K)
      IF(XRCDB(K).GT.XRCPK)XRCPK=XRCDB(K)
   44 CONTINUE
      JJ=JJ+1
      ALTI(JJ)=ALTBEG
      YLC(JJ)=XLCPK
      YRC(JJ)=XRCPK
      IF(JJ.EQ.2000)GO TO 121
C
   55 XOUTBG=XPPBEG
      XNUMO=IJCONT(LL)
      YSLVED=XSRANG(LL)
      IF(IPOLAR.EQ.1)XOUTBG=XOPBEG
      IBGG=IBLANK
      IF(LL.EQ.1)IBGG=IASTR
      WRITE(6,56)IBGG,IHRB,IMNB,ISCB,IXSB,TALBEG,RANBEG,YSLVED,ALTBEG,
     1TOTBEG,XOUTBG,NPRBEG,NUMPRI,XNUMO,RDOBEG
   56 FORMAT(//6X,A1,'TIME(GMT) ',I2,1X,I2,1X,I2,'.',I3,8X,'TAL ',F9.3,'
     1 RANGE(KM) ',F8.3,6X,'R.OFFST(M) = ',F9.1,7X,'HEIGHT (KM)',F7.1,/,
     23X,'TSEC',F10.3,3X,'AGC(DBSM) = ',F5.1,3X,'PRI(START)',2X,I5,2X,
     3' PRI(STOP)',2X,I5,3X,'NO.PULSES = ',F4.0,2X,'RDOT (M/SEC) = ',
     4F9.3)
```

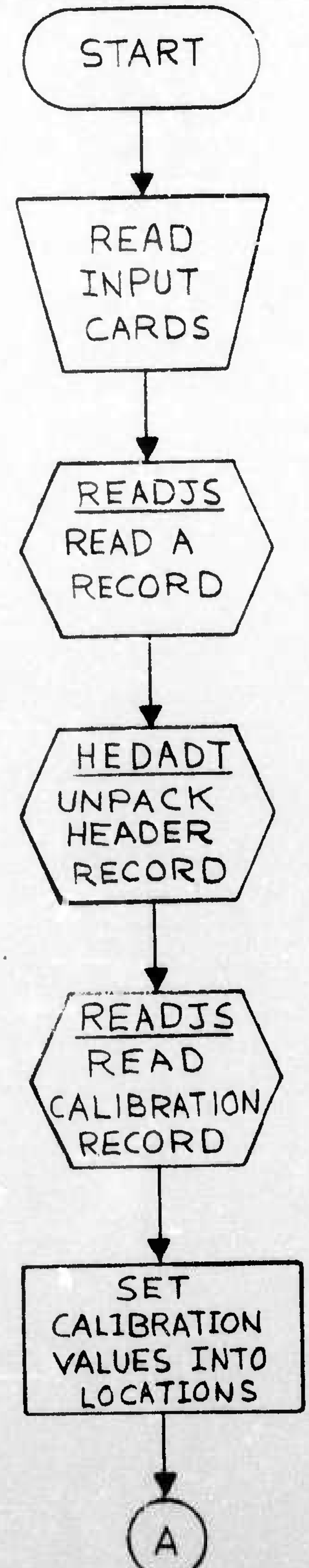
```
      NSWTCH=0
      INDX1=0
C
      DO 52 K=1,170
      IF(K.LT.ICELP1.OR.K.GT.ICELP2)GO TO 52
      IF(NSWTCH.EQ.1)GO TO 51
      IXA=K
      NSWTCH=1
   51 CONTINUE
      IXZ=K
      IOUT(K)=K
      INDX1=INDX1+1
      IF(K.EQ.ICELP2)GO TO 53
      IF(INDX1.NE.15)GO TO 52
   53 NSWTCH=0
      INDX1=0
      WRITE(6,59)(IOUT(N),N=IXA,IXZ)
   59 FORMAT(20X,'RANGE GATES',4X,15I6)
      WRITE(6,62)(XLCDB(N),N=IXA,IXZ)
   62 FORMAT(29X,'LC',4X,15F6.1)
      WRITE(6,63)(XRCDB(N),N=IXA,IXZ)
   63 FORMAT(29X,'RC',4X,15F6.1)
   52 CONTINUE
C
      DO 47 K=1,170
      IF(IPOLAR.EQ.1)GO TO 49
      YPRNT(K)=XLCDB(K)
      GO TO 47
   49 YPRNT(K)=XRCDB(K)
   47 CONTINUE
      IF(IPLOT.NE.0)GO TO 60
      INDIC=1
      XPOFFS=XSRANG(LL)
   48 CALL PLOTT(INDIC ,  YPRNT(1),NCELL1,NCELL2,ITBAND,IPOLAR,NPRBEG,
     1NPREND,DBB,DBT,ALTBEG,YALBEG,XHRB,XMNB,XSCB,XXSB,XPOFFS,XNUMO)
   60 CONTINUE
C
   79 CONTINUE
      NM=1
      NPRMRY=0
      DO 82 M=1,JX
      IJCONT(M)=0
      XSRANG(M)=0.
      DO 82 K=1,170
      IAVLC(M,K)=0
      IAVRC(M,K)=0
      XLCSUM(M,K)=0.
      XRCSUM(M,K)=0.
   82 CONTINUE
C
      IFRST4=0
      IFRST1=0
  118 IF(NUMPRI.LT.NSTOP(IJ))GO TO 3
      IPULS=0
  119 IFRST3=0
  120 CONTINUE
C
```

```
 121 CCNTINUE
     IF(IPUNC.EC.1)GO TO 128
     WRITE(7,131)ZLC,ZBAN,TITL
 131 FORMAT(A2,2X,A2,2X,A4)
     00 122 K=1,JJ
 122 WRITE(7,133)ALTI(K),YLC(K)
 133 FORMAT(2F1C.3)
     WRITE(7,131)ZRC,ZBAN,TITL
     00 126 K=1,JJ
 126 WRITE(7,133)ALTI(K),YRC(K)
 128 INDIC=2
 129 CALL PLOTT(INDIC ,  YPRNT(1),NCELL1,NCELL2,ITBANO,IPCLAR,NPRBEG,
    1NPREND,OBB,CBT,ALTBEG,TALBEG,XHRB,XMNB,XSCB,XXSB,XPCFFS,XNUMO)
C
     GO TO 125
 103 WRITE(6,107)NUMPRI
 107 FORMAT('OPARITY ERROR ON READ AFTER PRI = ',I1C)
     GO TO 99
 680 WRITE(6,109)NUMPRI
 109 FORMAT(' END OF FILE REACHEO LAST NUMPRI VALUE = ',I10)
     GO TO 125
 695 WRITE(6,114)NBAND,ITBAND
 114 FORMAT(' INPUT BAND= 'I1C,'   BAND ON TAPE = 'I10)
 125 RETURN
     ENO
     SUBROUTINE PLOTT (INOIC,YPRNT,NCELL1,NCELL2,ITBANO,IPOLAR,NPRBEG,
    1NPREND,DBB,CBT,ALTBEG,TALBEG,XHRB,XMNB,XSCB,XXSB,XPOFFS,XNUMC)
C
     DOUBLE PRECISION TALBEG
     DIMENSION XPRNT(170),YPRNT(1),XWCRO(4)
C
     COMMON /ICLZ/ JJ,TITL,ALTI(2000),YLC(2000),YRC(2000)
     OATA XWORO/'NBLCNBRCWBLCWBRC'/,NTIME/0/,ICNCE/0/
C
C        IPOLAR = 0 LEFT CIRCULAR DATA REQUESTED
C        IPOLAR = 1 RIGHT CIRCULAR OATA REQUESTED
C        IBANO = 0  NARROW BANO OATA REQUESTED
C        IBANO = 1  WIDE BANC DATA REQUESTED
C
     ZALBEG=TALBEG
     IF(IONCE.EC.1)GO TO 10
     CALL STOIOV('ALCTAP',5,0)
     ML=100
     MR=940
     MB=200
     MT=940
     IF(NCELL1.EQ.0)NCELL1=1
     IF(NCELL2.EQ.0)NCELL2=170
     XCELL1=NCELL1
     XCELL2=NCELL2
     IF(ABS(OBB).LE..C05)OBB=-60.
     IF(ABS(OBT).LE..C05)DBT= 40.
     OO 7 K=1,170
     XPRNT(K)=K
   7 CCNTINUE
     ICNCE=1
  10 CONTINUE
```

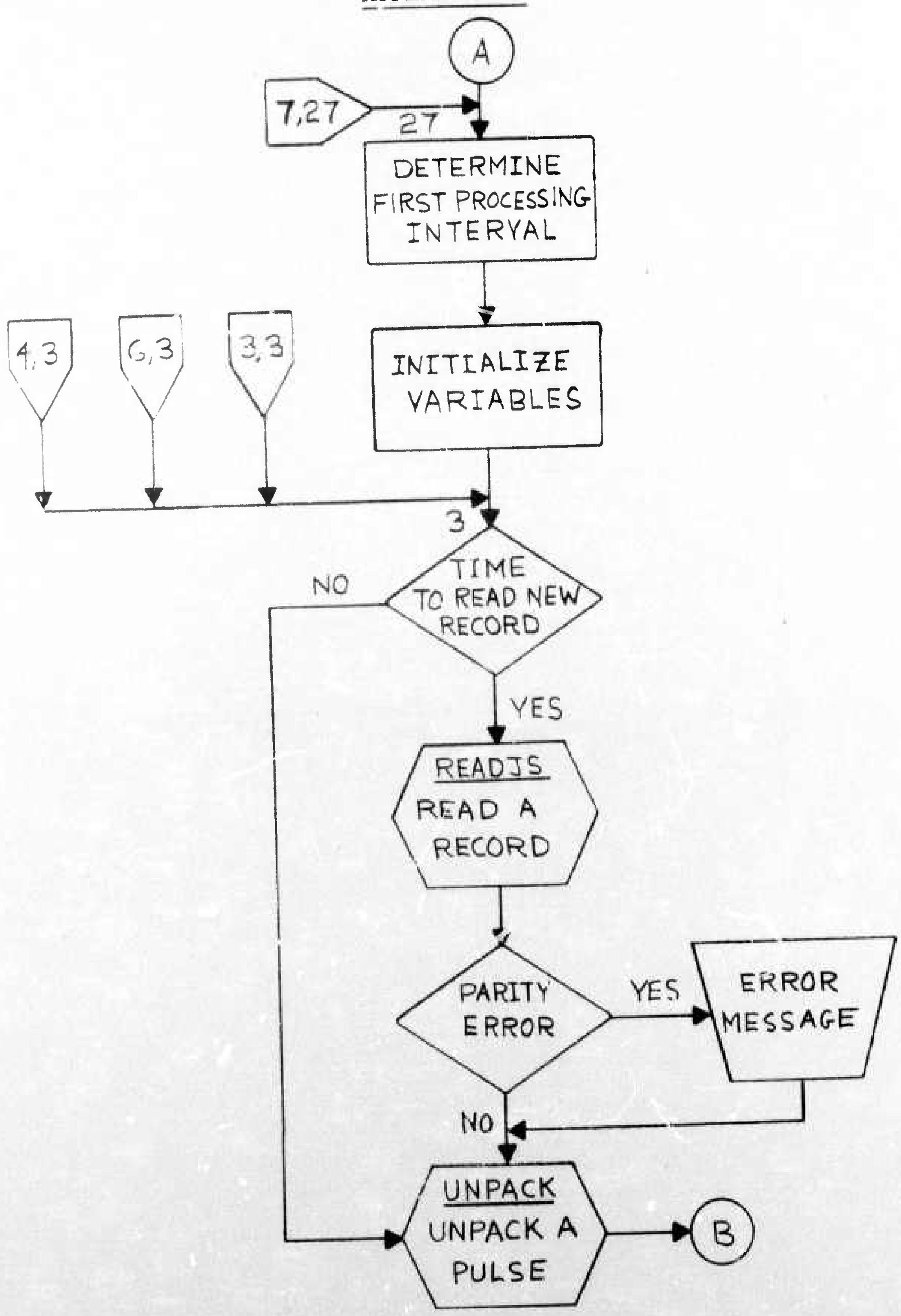
```
C
   11 IF(INDIC.EQ.1)GO TO 13
      XCELL1=70.
      XCELL2=0.
   13 CONTINUE
C
      CALL LINEV (ML,MB,ML,MT)
      CALL LINEV (ML,MT,MR,MT)
      CALL LINEV (MR,MT,MR,MB)
      CALL LINEV (MR,MB,ML,MB)
C
      CALL YSCALV (DBB,DBT,MB,1023-MT)
      CALL LINRV (2,ML-35,ML-5,ML+5,DBB,DBT,10.,1,1,3,10)
      CALL LINRV (2,MR+35,MR-5,MR+5,DBB,DBT,10.,1,0,0,10)
C
      IF(INDIC.EQ.1)GO TO 16
      M1=2
      M2=2
      Z1=5.
      GO TO 33
C
   16 M1=5
      M2=5
      Z1=2.
      IF((NCELL2-NCELL1).GT.85)GO TO 14
      Z1=1.
   14 CONTINUE
C
      IF(ITBAND.EQ.0)GO TO 30
      XLRNG=(XCELL1-1.)*.177515
      XRRNG=(XCELL2-1.)*.177515
      Z2=1.
      N1=5
      N2=5
      GO TO 31
   30 XLRNG=(XCELL1-1.)*14.7929
      XRRNG=(XCELL2-1.)*14.7929
      Z2=100
      N1=2
      N2=2
   31 CONTINUE
C
      CALL XSCALV (XLRNG,XRRNG,ML,1023-MR)
      CALL LINRV(1,MB-20,MB-5,MB+5,XLRNG,XRRNG,Z2,N1,N2,4,8)
   33 CALL XSCALV (XCELL1,XCELL2,ML,1023-MR)
      IF(INDIC.EQ.1)GO TO 34
      CALL LINRV(1,MB-20,MB-5,MB+5 ,XCELL1,XCELL2,Z1,M1,M2,3,8)
      CALL LINRV(1,MT+20,MT+5,MT-5,XCELL1,XCELL2,Z1,M1,0,0,8)
      GO TO 36
   34 CALL LINRV(1,MT+20,MT+5,MT-5 ,XCELL1,XCELL2,Z1,M1,M2,3,8)
   36 CONTINUE
C
      BPRBEG=NPRBEG
      BPREND=NPREND
      IF(ITBAND.EQ.0.AND.IPOLAR.EQ.0)XUSE=XWCRD(1)
      IF(ITBAND.EQ.0.AND.IPOLAR.EQ.1)XUSE=XWCRD(2)
      IF(ITBAND.EQ.1.AND.IPOLAR.EQ.0)XUSE=XWCRD(3)
```

```
      IF(ITBAND.EQ.1.AND.IPOLAR.EQ.1)XUSE=XWCRD(4)
      IF(INDIC.EQ.1)GO TO 35
      CALL RITE2V(0,MB+250,1023,90,2,20,1,'PEAK WAKE RCS (DBSM)',NLAST)
      CALL RITE2V(ML+350,MB-50,1023,0,2,13,1,'ALTITUDE (KM)',NLAST)
      CALL RITE2V(ML+800,MT+50,1023,0,2,4,1,XUSE,NLAST)
      CALL RITE2V(ML,MT+50,1023,0,2,4,1,TITL,NLAST)
      JJJ=JJ-1
   53 DO 57 I=1,JJJ
      J=I+1
      IX1=NXV(ALTI(I))
      IY1=NYV(YLC(I))
      IF(INDIC.EQ.3)IY1=NYV(YRC(I))
      IX2=NXV(ALTI(J))
      IY2=NYV(YLC(J))
      IF(INDIC.EQ.3)IY2=NYV(YRC(J))
      CALL LINEV(IX1,IY1,IX2,IY2)
   57 CONTINUE
      GO TO (59,63,58),INDIC
   63 INDIC=3
      IPOLAR=1
      GO TO 59
C
   58 CALL PLTND
      GO TO 60
   35 CALL RITE2V (0,MB+350,1023,90,2,8,1,'RCS DBSM',NLAST)
      CALL RITE2V (ML+350,MB-50,1023,0,2,13,1,'RANGE  METERS',NLAST)
      CALL RITE2V (ML+350,MT+50,1023,0,2,16,1,'RANGE SAMPLE NO.',NLAST)
      CALL RITE2V (ML+800,MT+50,1023,0,2,4,1,XUSE,NLAST)
      CALL RITE2V(ML,MT+50,1023,0,2,4,1,TITL,NLAST)
      CALL PRINTV (14,'PRI START-STOP',ML,MB-150)
      CALL PRINTV (4,'GMT ',ML+200,MB-150)
      CALL PRINTV (9,'TAL (SEC)',ML+400,MB-150)
      CALL PRINTV (12,'ALTITUDE(KM)',ML+600,MB-150)
      CALL PRINTV (20,'RANGE OFFSET (M) =  ',ML+15,MT-15)
      CALL PRINTV(21,'NO. OF PULSES USED = ',ML+15,MT-35)
      CALL LABLV(XPOFFS,ML+170,MT-15,7,1,5)
      CALL LABLV(XNUMO,ML+155,MT-35,5,1,5)
      CALL LABLV (BPRBEG,ML,MB-170,5,1,5)
      CALL LABLV (BPREND,ML,MB-190,5,1,5)
      CALL LABLV (XHRB,ML+200,MB-170,2,1,2)
      CALL LABLV (XMNB,ML+230,MB-170,2,1,2)
      CALL LABLV (XSCB,ML+260,MB-170,2,1,2)
      CALL LABLV (XXSB,ML+290,MB-170,3,1,3)
      CALL LABLV (ZALBEG,ML+400,MB-170,7,1,4)
      CALL LABLV (ALTBEG,ML+600,MB-170,6,1,4)
C
      DO 50 I=1,169
      J=I+1
      IF(I.LT.NCELL1.OR.J.GT.NCELL2)GO TO 50
      IX1=NXV(XPRNT(I))
      IY1=NYV(YPRNT(I))
      IX2=NXV(XPRNT(J))
      IY2=NYV(YPRNT(J))
      CALL LINEV(IX1,IY1,IX2,IY2)
   50 CONTINUE
C
   59 CALL FRAMEV(0)
      IF(INDIC.EQ.3)GO TO 11
   60 RETURN
      END
```

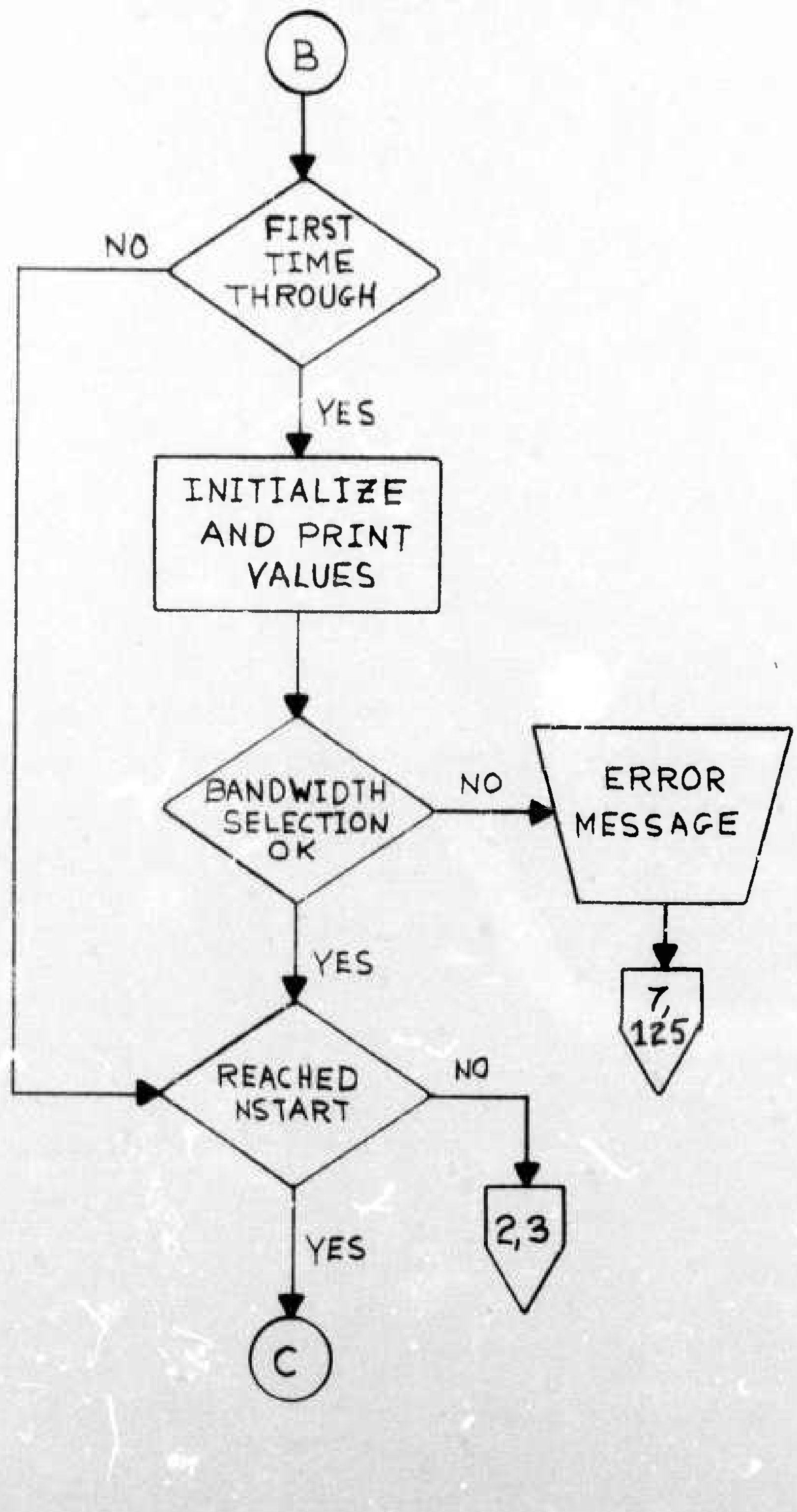
APPENDIX D
TAPALC FLOW DIAGRAM

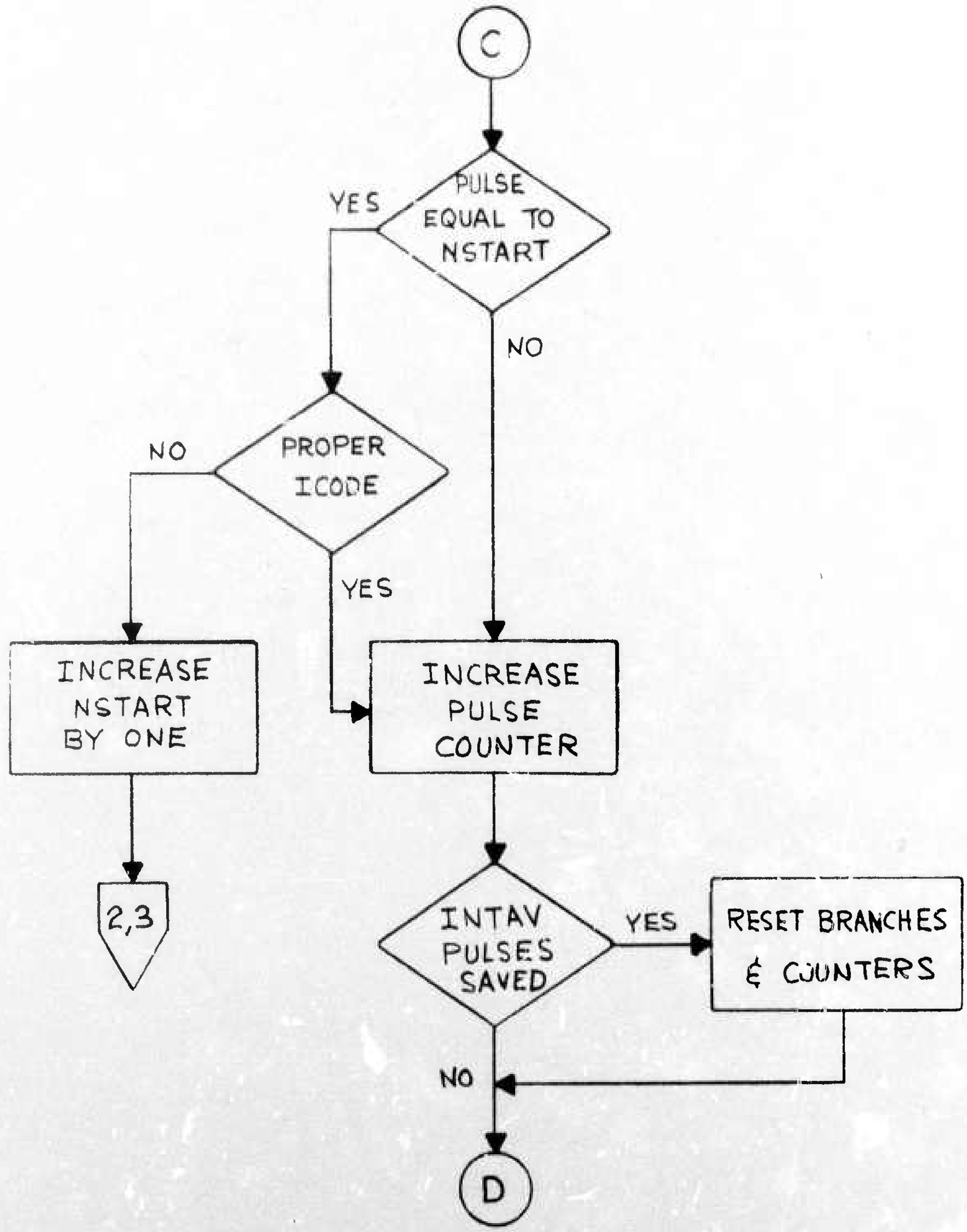


APPENDIX D-2

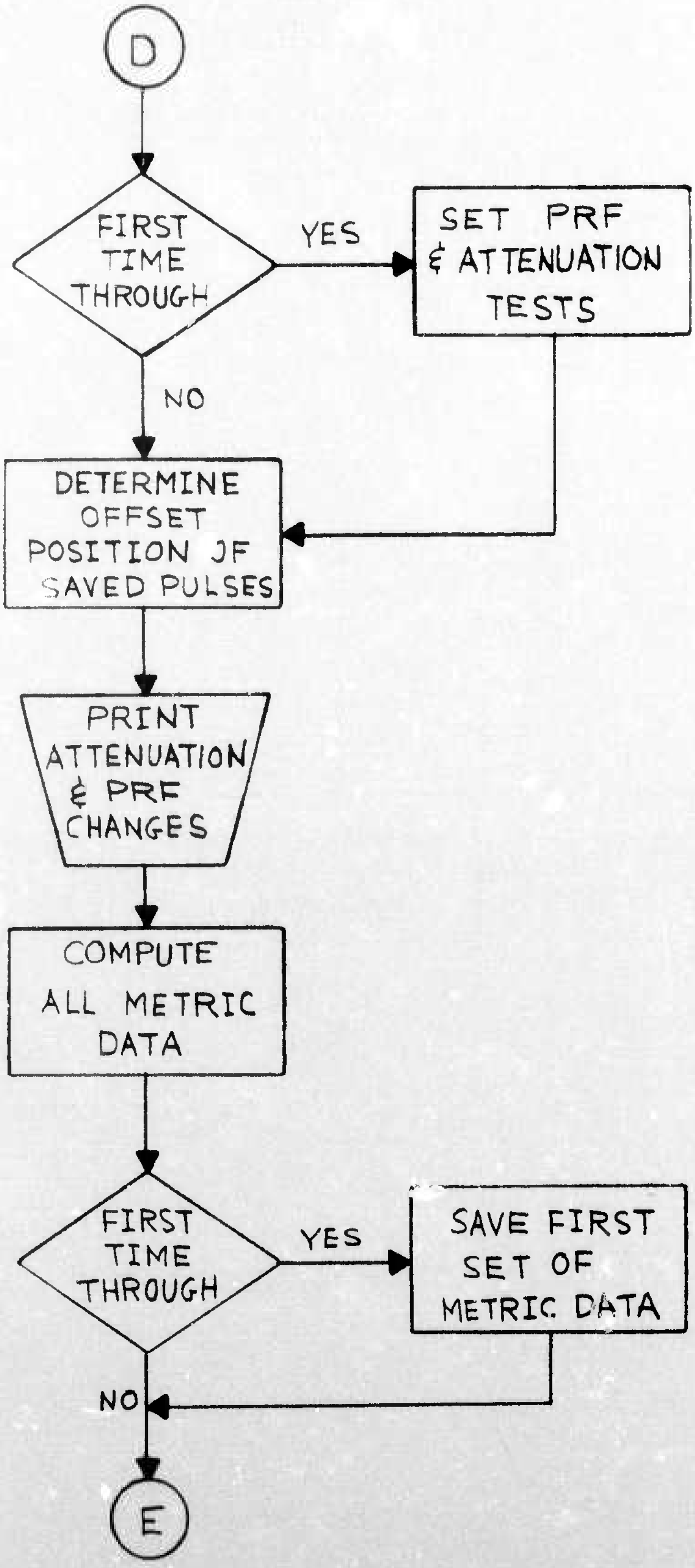

A
7,27
27
DETERMINE FIRST PROCESSING INTERVAL
4,3
6,3
3,3
INITIALIZE VARIABLES
3
TIME TO READ NEW RECORD
NO
YES
READJS
READ A RECORD
PARITY ERROR
YES
ERROR MESSAGE
NO
UNPACK
UNPACK A PULSE
B

APPENDIX D-3

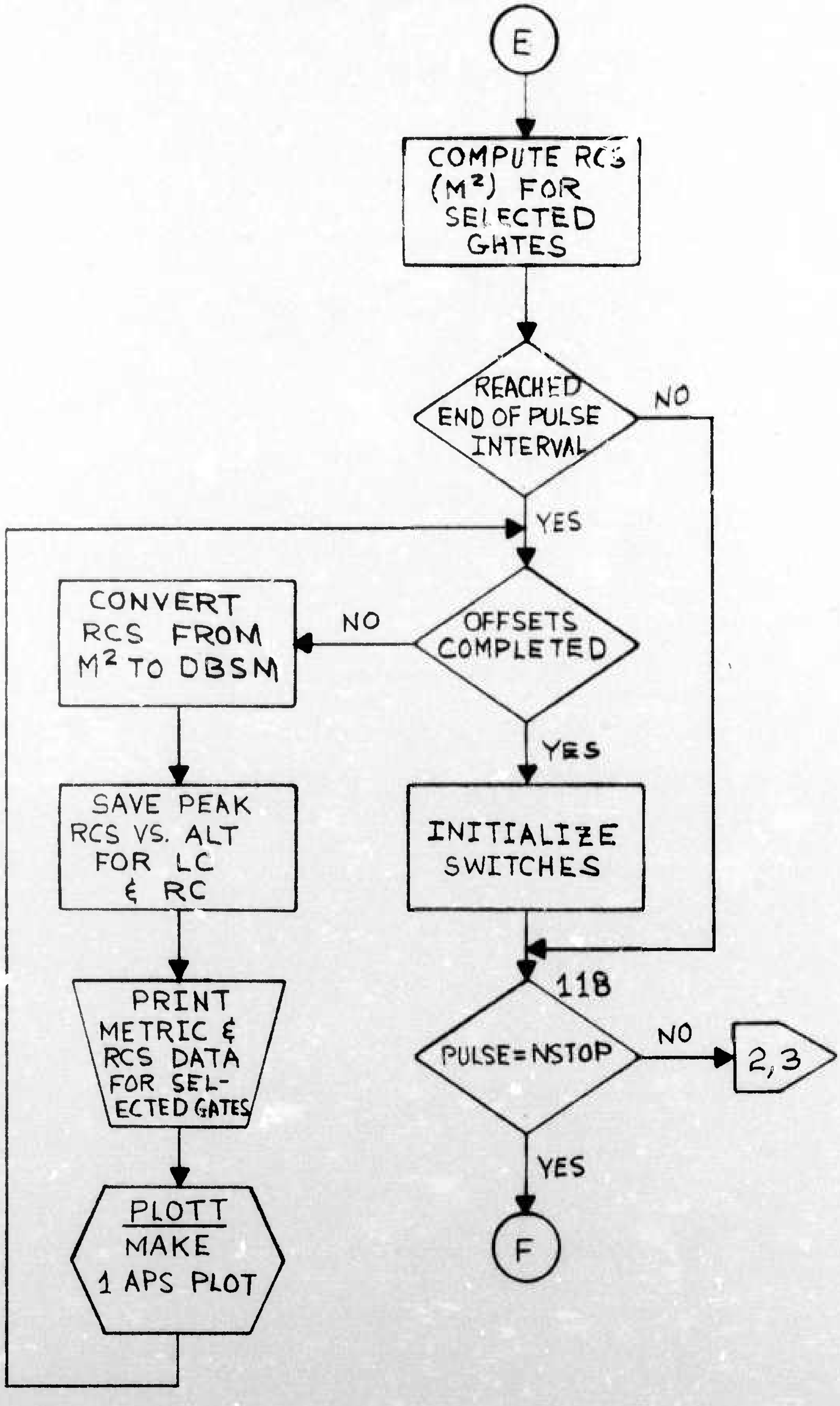

B
FIRST
TIME
THROUGH
NO
YES
INITIALIZE
AND PRINT
VALUES
BANDWIDTH
SELECTION
OK
NO
ERROR
MESSAGE
7,
125
YES
REACHED
NSTART
NO
2,3
YES
C

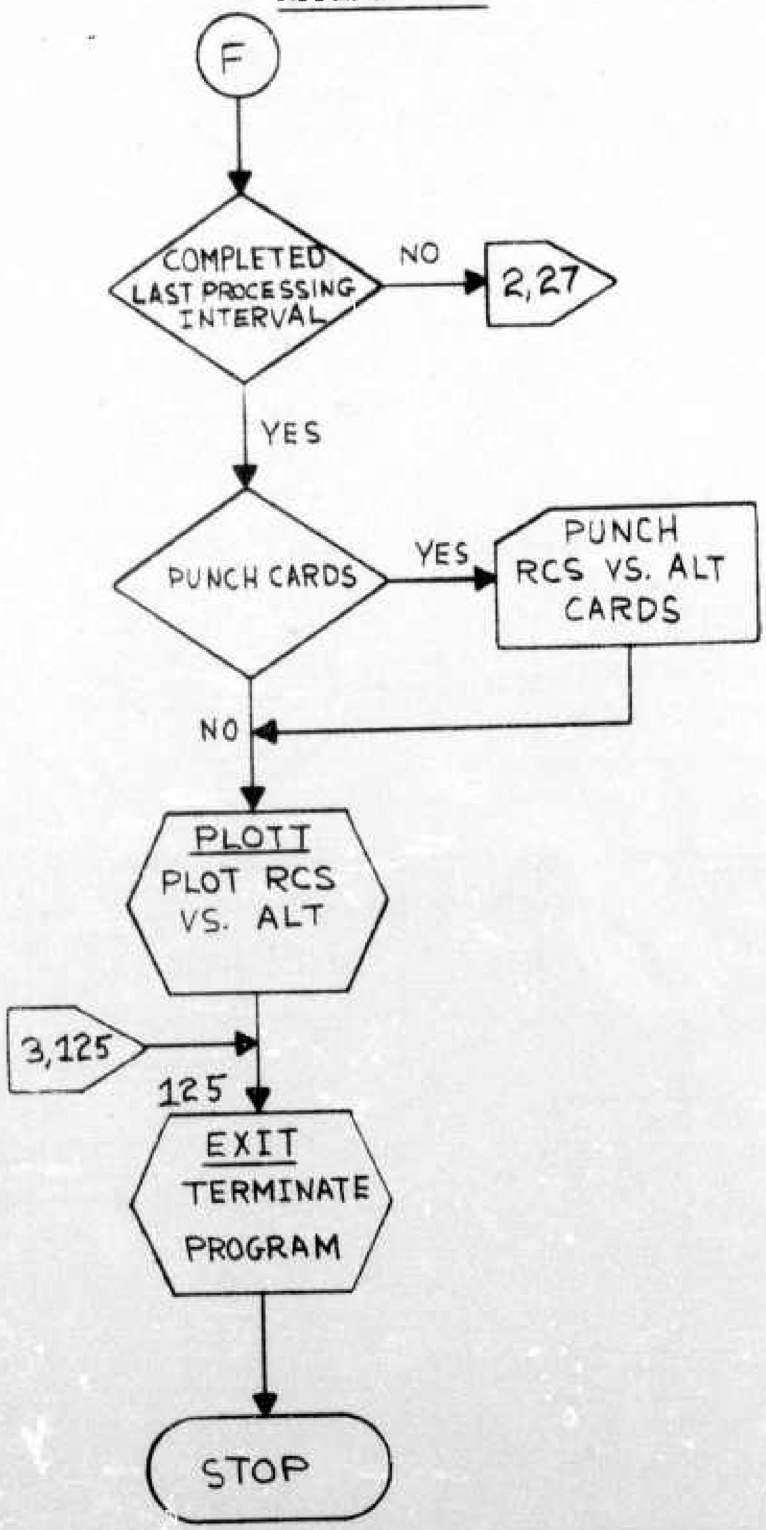

C
PULSE EQUAL TO NSTART
YES
NO
PROPER ICODE
NO
YES
INCREASE NSTART BY ONE
INCREASE PULSE COUNTER
2,3
INTAV PULSES SAVED
YES
RESET BRANCHES & COUNTERS
NO
D

APPENDIX D-5


D
FIRST TIME THROUGH
YES
SET PRF & ATTENUATION TESTS
NO
DETERMINE OFFSET POSITION JF SAVED PULSES
PRINT ATTENUATION & PRF CHANGES
COMPUTE ALL METRIC DATA
FIRST TIME THROUGH
YES
SAVE FIRST SET OF METRIC DATA
NO
E

APPENDIX D-6


E
COMPUTE RCS (M²) FOR SELECTED GATES
REACHED END OF PULSE INTERVAL
NO
YES
OFFSETS COMPLETED
NO
CONVERT RCS FROM M² TO DBSM
SAVE PEAK RCS VS. ALT FOR LC & RC
PRINT METRIC & RCS DATA FOR SEL-ECTED GATES
PLOTT
MAKE 1 APS PLOT
YES
INITIALIZE SWITCHES
118
PULSE=NSTOP
NO
2,3
YES
F


F
COMPLETED LAST PROCESSING INTERVAL
NO
2,27
YES
PUNCH CARDS
YES
PUNCH RCS VS. ALT CARDS
NO
PLOTT
PLOT RCS VS. ALT
3,125
125
EXIT
TERMINATE PROGRAM
STOP

APPENDIX E
SUBROUTINE HEDADT PROGRAM LISTING

```
*              CALL HEDADT (ISIG,INBUF,IEQU)
*              ISIG = 1     UNPACK THE 20 WORD ADT HEADER
         START
         ENTRY HEDADT
         SPACE
XISIG    EQU   4
XICAL    EQU   5
XIEQU    EQU   6
BASE     EQU   12
         SPACE
HEDADT   SAVE  (14,12),T,*
         BALR  12,0
         USING *,BASE
         ST    13,SAVEA+4
         LA    7,SAVEA
         ST    7,8(0,13)
         LR    13,7
         SPACE
         LM    XISIG,XIEQU,0(1)
         SPACE
         L     8,0(XICAL)
         ST    8,TEMP1
         ST    8,TEMP2
         SRL   8,31
         ST    8,0(XIEQU)      MBAND
         L     8,TEMP1
         SLL   8,1
         SRL   8,25
         ST    8,4(XIEQU)      MREEL
         SPACE
         L     8,4(XICAL)
         ST    8,TEMP1
         ST    8,TEMP2
         SRL   8,16
         ST    8,8(XIEQU)      MWTR
         L     8,TEMP1
         SLL   8,16
         SRL   8,24
         ST    8,12(XIEQU)     MMNTH
         L     8,TEMP2
         SLL   8,24
         SRL   8,24
         ST    8,16(XIEQU)     MDAY
         SPACE
         SR    8,8
         IC    8,8(XICAL)
         ST    8,20(XIEQU)     MYEAR
         MVC   24(9,XIEQU),9(XICAL)      MISSION DES.
         SPACE
RETURN   L     13,SAVEA+4
         RETURN (14,12),T
         CNOP  0,4
TEMP1    DC    F'0'
TEMP2    DC    F'0'
SAVEA    DC    18A(*)
         END
```

APPENDIX F
SUBROUTINE REFC PROGRAM LISTING

VERSION 6/16/70

```
      SUBROUTINE REFC(E,R,DEE,DRR)
      DIMENSION DE(16,8),DR(16,8),ED(16),RD(8)
      DATA DE/0.0    ,0.0    ,0.0    ,0.0    ,0.0    ,0.0    ,0.0    ,0.0    ,
     10.0    ,0.0    ,0.0    ,0.0    ,0.0    ,0.0    ,0.0    ,0.0    ,0.0313,
     20.0303,0.0292,0.0287,0.0282,0.0272,0.0262,0.0253,0.0243,0.0223,
     30.0214,0.0195,0.0171,0.0135,0.0075,0.0    ,0.0937,0.0848,0.0770,
     40.0732,0.0694,0.0627,0.0571,0.0522,0.0480,0.0412,0.0385,0.0337,
     50.0278,0.0205,0.0105,0.0    ,0.1850,0.1520,0.1250,0.1140,0.1050,
     60.0904,0.0795,0.0708,0.0636,0.0523,0.0478,0.0405,0.0323,0.0229,
     70.0114,0.0    ,0.5310,0.3070,0.2120,0.1830,0.1600,0.1280,0.1060,
     80.0899,0.0780,0.0612,0.0550,0.0455,0.0354,0.0246,0.0120,0.0    ,
     90.7550,0.3720,0.2400,0.2020,0.1750,0.1370,0.1120,0.0942,0.0811,
     A0.0631,0.0566,0.0466,0.0361,0.0250,0.0122,0.0    ,0.9120,0.4110,
     B0.2560,0.2140,0.1840,0.1420,0.1150,0.0967,0.0830,0.0643,0.0575,
     C0.0472,0.0365,0.0252,0.0122,0.0    ,0.9700,0.4200,0.2600,0.2200,
     D0.1900,0.1460,0.1170,0.0980,0.0840,0.0653,0.0584,0.0478,0.0369,
     E0.0254,0.0123,0.0 /
      DATA DR/  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,
     1  0.0,  0.0,  0.0,  0.0,  0.0,  0.0,  0.0, 22.6, 21.5, 20.4, 19.9,
     2 19.4, 18.5, 17.6, 16.8, 16.1, 14.8, 14.2, 13.2, 12.0, 10.4,  8.6,
     3  7.7, 67.3, 57.9, 50.2, 47.0, 44.1, 39.3, 35.4, 32.1, 29.3, 24.8,
     4 22.9, 19.7, 16.3, 12.7,  9.4,  8.1,132.0, 98.5, 77.4, 69.7, 63.2,
     5 52.9, 44.7, 38.4, 33.4, 26.4, 23.9, 20.1, 16.4, 12.7,  9.4,  8.1,
     6340.0,167.0,103.0, 86.1, 73.4, 56.7, 46.2, 38.9, 33.6, 26.4, 24.0,
     7 20.2, 16.4, 12.8,  9.5,  8.2,405.0,170.0,104.0, 86.3, 73.6, 56.8,
     8 46.3, 38.9, 33.7, 26.5, 24.1, 20.3, 16.5, 12.8,  9.5,  8.2,421.0,
     9171.0,104.0, 86.6, 73.9, 57.1, 46.4, 39.0, 33.8, 26.8, 24.3, 20.5,
     A 16.6, 13.0,  9.8,  8.4,446.0,172.0,105.0, 87.4, 74.0, 58.0, 46.6,
     B 39.2, 34.0, 27.0, 24.6, 20.7, 16.7, 13.0, 10.0,  8.4/
      DATA ED,RTDEG/0.01,2.0,4.0,5.0,6.0,8.0,10.0,12.0,14.0,18.,20.,
     124.,30.,40.,60.,90.,57.29578/
      DATA RD/0.01,10.,30.,60.,200.,400.,1000.,2000./
      IF(R.LE.0.0)GO TO 300
      RG=R/1.852D+00
      DO 100 IED=2,15
      I=17-IED
      IF(E.GE.ED(I))GO TO 120
  100 CONTINUE
      I=1
  120 DO 200 JRD=2,8
      J=10-JRD
      IF(RG.GE.RD(J))GO TO 220
  200 CONTINUE
      J=1
  220 IF(J.EQ.8)GO TO 340
      ZR=ALOG(RG/RD(J))/ALOG(RD(J+1)/RD(J))
      IF(E.LE.0.0)GO TO 320
      ZE=ALOG(E/ED(I))/ALOG(ED(I+1)/ED(I))
      DE1=((DE(I+1,J)-DE(I,J))*(1.-ZR)+(DE(I,J+1)-DE(I,J))*ZR)*ZE
      DE2=((DE(I,J+1)-DE(I,J))*(1.-ZE)+(DE(I+1,J+1)-DE(I,J+1))*ZE)*ZR
      DEE=DE1+DE2+DE(I,J)
      DR1=((DR(I+1,J)-DR(I,J))*(1.-ZR)+(DR(I,J+1)-DR(I,J))*ZR)*ZE
      DR2=((DR(I,J+1)-DR(I,J))*(1.-ZE)+(DR(I+1,J+1)-DR(I,J+1))*ZE)*ZR
      DRR=(DR1+DR2+DR(I,J))
      GO TO 400
  300 DEE=0.0
      DRR=0.0
      GO TO 400
  320 DEE=DE(I,J)+(DE(I,J+1)-DE(I,J))*ZR
      DRR=DR(I,J)+(DR(I,J+1)-DR(I,J))*ZR
      GO TO 400
  340 DELT=(E-ED(I))/(ED(I+1)-ED(I))
      DEE=DELT*(DE(I+1,J)-DE(I,J))+DE(I,J)
      DRR=DELT*(DR(I+1,J)-DR(I,J))+DR(I,J)
  400 DRR=DRR*.30480D-03
      RETURN
      END
```